JP 10 176223 A

④

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-176223
(43)Date of publication of application : 30.06.1998

---

(51)Int.Cl.
C21D 9/46
C21D 6/00
C21D 8/02
C22C 38/00
C22C 38/32
C22C 38/54

---

(21)Application number : 08-337362
(22)Date of filing : 17.12.1996
(71)Applicant : NIPPON STEEL CORP
(72)Inventor : ABE MASAYUKI
KIMURA KEN
SENUMA TAKEHIDE
KOSEKI TOSHIHIKO

---

(54) MANUFACTURE OF FERRITIC STAINLESS STEEL EXCELLENT IN SURFACE CHARACTERISTIC

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a method for manufacture of a ferritic stainless steel, capable of preventing the occurrence of roping at the time of cold rolling in the process where hot rolled plate annealing is omitted.
SOLUTION: A ferritic stainless steel, having a composition which consists of, by weight, 0.025-0.080% C, 0.0010-0.035% N, 11.0-20.0% Cr, &le;0.010% S, &le;0.04% P, 0.01-1.0% Mn, 0.01-1.0% Si, &le;0.5% Ni, &le;0.5% Cu, &le;0.2% Mo, &le;0.010% O, >0.005-0.05% B, 0.001-0.5% V, and the balance Fe with inevitable impurities and in which the value of &gamma;p represented by an equation &gamma;p=420 × C +470 × N+23 × Ni+12 × Cu+7 × Mn-11.5 × Cr-11.5 × Si-11 × Mo-52 × Al-49 × Ti+189 is regulated to 20-60%, is used. At the time of hot-rolling this ferritic stainless steel, heating temp. is regulated to 1150-1300° C and cumulative draft at &ge;1100° C is regulated to &ge;40% at the time of roughing, and successively, finish rolling is carried out and coiling temp. is regulated to &le;600° C. Then, acid pickling is applied without performing hot rolled plate annealing, and cold rolling and final annealing are carried out.

LEGAL STATUS

[Date of request for examination]	29.03.2002
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

Copyright (C); 1998,2000 Japan Patent Office

* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] By weight %, C:0.025 - 0.080%, N:0.0010 - 0.035%, Cr: 11.0-20.0%, S:0.010% or less, P:0.04% or less, Mn: 0.01-1.0%, Si:0.01-1.0%, less than [nickel:0.5%], Cu: Less than [0.5%], less than [Mo:0.2%], O:0.010% or less, B:0.005% ** -0.05% and V:0.001 - 0.5% are contained. gammap shown by the lower formula by the remainder consisting of Fe and an unescapable impurity The ferritic stainless steel which is 20 - 60% On the occasion of hot rolling, make heating temperature into 1150 degrees C or more 1300 degrees C or less, and an accumulation rolling reduction 1100 degrees C or more is made into 40% or more in rough rolling. The manufacture method of the ferritic stainless steel excellent in the surface characteristic characterized by carrying out finishing rolling succeedingly, carrying out pickling and carrying out cold-rolling and the last annealing, without making **** temperature into 600 degrees C or less, and carrying out hot-rolling board annealing henceforth.
gammap =420xC+470xN+23xnickel+12xCu+7xMn-11.5xCr-11.5xSi-11xMo-52xaluminum-49xTi+189. [Claim 2] The manufacture method of the ferritic stainless steel excellent in the surface characteristic according to claim 1 which is weight % and is characterized by containing one or more sorts (aluminum:0.005-0.03% and Ti:0.005-0.05%) further.
[Claim 3] The manufacture method of the ferritic stainless steel excellent in the surface characteristic according to claim 2 which is weight % and is characterized by containing Mg:0.0005-0.02% further.

[Translation done.]

* NOTICES *

Japan Patent Office is not responsibl for any
damages caused by the use of this translation.

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the manufacture method of ferritic-stainless-steel sheet metal that the minute external waviness (roping) generated in a ferritic-stainless-steel manufacture process at the time of cold-rolling was small excellent in the surface characteristic.
[0002]
[Description of the Prior Art] Since nickel content is a low price few compared with an austenitic stainless steel, a ferritic stainless steel begins a kitchen instrument etc. and is used widely. especially, in the case of such a use, beautiful [surface] requires — having — a front face — a character serves as an important product property However, the ferritic stainless steel needed to be easy to generate the surface irregularity called RIJINGU at the time of a fabricating operation, and to reduce RIJINGU. This RIJINGU is the surface irregularity of 5-50-micrometer height generated at the time of processing, and the generating mechanism is also examined as many things are conventionally examined about how to improve RIJINGU of a ferritic stainless steel, for example, it is stated to iron and steel (76(1990) P.1520).
[0003] Thus, from a viewpoint of an improvement of a surface characteristic, importance has been attached to reduction of RIJINGU until now. However, recently, when cold-rolling of the hot-rolling board of a ferritic stainless steel is carried out as the demand to surface grace became still severer, reduction of the minute wave generated on the front face of a cold-rolled board came to be needed. Although this minute wave is a wave extended in a height of 0.2 micrometers - about 0.5 micrometers on the front face of a cold-rolled board at the rolling direction and is a remarkable small wave compared with RIJINGU, it is the important factor which determines the surface characteristic of a product. This minute external waviness is called roping in distinction from RIJINGU generated at the time of the fabricating operation of a product.
[0004] Moreover, the actual condition is that manufacturability is inferior to SUS304 which is the representation steel type of an austenitic stainless steel, such as carrying out box annealing which needs dozens of hours after hot-rolling, in SUS430 steel which is the typical steel type of a ferritic stainless steel. Although much continuous-annealing-ized technology of hot-rolling board annealing and many hot-rolling board annealing ellipsis processes are also examined in order to simplify the manufacture process of SUS430 from such a viewpoint, there is nothing aiming at all improving the above-mentioned roping.
[0005]
[Problem(s) to be Solved by the Invention] Although roping is considered as the same phenomenon as RIJINGU and can be cooked, until now It cannot necessarily be told that good correspondence is to RIJINGU generating at the time of a fabricating operation, and generating of roping at the time of cold rolling. Since a cold-rolled rolling reduction becomes so small that it becomes high and, as for roping height, the generating mechanism of roping — RIJINGU differs from generating behavior — is not clear to the height becoming large, either, if, especially as for RIJINGU, working ratio becomes high, It is necessary to establish the manufacture method that roping can be reduced.
[0006] However, adding a new process to a process conventionally for roping reduction has large possibility of losing the merit of a cheap ferritic stainless steel. Then, if roping generating can be reduced in the hot-rolling board annealing abbreviation process that ****** progressed most, the ferritic stainless steel excellent in the surface characteristic can be offered still more cheaply.
[0007] Therefore, the purpose of this invention is in a hot-rolling board annealing process to offer the manufacture method of the ferritic stainless steel excellent in the roping-proof property, without making a process newly increase.
[0008]
[Means for Solving the Problem] this invention person etc. examined various methods of reducing roping in the manufacture process which omitted hot-rolling board annealing of a ferritic stainless steel. Consequently, the knowledge of the ability to reduce roping also in the process which omitted hot-rolling board annealing was carried out by controlling a series of process conditions of a component, heating conditions, hot-rolling conditions, and **** conditions consistently.
[0009] Namely, this invention is weight %. C:0.025 - 0.080%, N : 0.0010 - 0.035%, Cr: 11.0-20.0% S : 0.010% or less, P:0.04% or less, Mn: 0.01-1.0%, Si: 0.01-1.0% Less than [nickel:0.5%] Less than [Cu:0.5%] Less than [Mo:0.2%] O:0.010% or less B : 0.005% ** -0.05%.
[0010] Contain V:0.001 - 0.5%, and the remainder consists of Fe and an unescapable impurity. gammap shown by the lower formula The ferritic stainless steel which is 20 - 60% On the occasion of hot rolling, make heating temperature into 1150 degrees C or more 1300 degrees C or less, and an accumulation rolling reduction 1100 degrees C or more is made into 40% or more in rough rolling. It is the manufacture method of the ferritic stainless steel excellent in the surface characteristic characterized by carrying out pickling and carrying out cold-rolling and the last annealing, without carrying out finishing rolling succeedingly, making **** temperature into 600 degrees C or less, and carrying out hot-rolling board annealing henceforth.
[0011] In the gammap =420xC+470xN+23xnickel+12xCu+7xMn-11.5xCr-11.5xSi-11xMo-52xaluminum-49xTi+189 above-mentioned method It is desirable to perform compound addition with Mg:0.0005-0.02% by weight % further if needed in addition to one or more sorts of addition of aluminum:0.005-0.03% and Ti:0.005-0.05% and this.
[0012]
[Embodiments of the Invention] Hereafter, this invention is explained in detail. this invention person etc. inquired in

detail in the laboratory for the purpose of reduction of the minute external waviness (roping) generated at the time of cold-rolling of a ferritic stainless steel. this invention person etc. changed various components of the ferrite system stainless steel network which uses Cr as a representation component 17% in the vacuum melting of a laboratory, and ingoted 50kg steel ingot. When conducting a hot-rolling experiment for this steel ingot in a laboratory and manufacturing a 3mm hot-rolling board, heating conditions, rough rolling conditions, finish hot-rolling conditions, and **** conditions were changed, and the relation with the roping generating behavior at the time of cold-rolling was investigated. Pickling was carried out without annealing the above-mentioned hot-rolling board, and roping performed cold-rolling to 0.4mm, it measured with the relative roughness plan about 10mm length in the right-angled direction to the direction of cold-rolling, and was taken as roping height with the maximum of external waviness height. Three places of this measurement were carried out and the average estimated roping.
[0013] A rank and 0.15 micrometers or more less than 0.25 micrometers evaluated B rank, and 0.25 micrometers or more - less than 0.35 micrometers evaluated [the average of the roping maximum height whose evaluation is three places / less than 0.15 micrometers] C rank and 0.35 micrometers or more as a D rank. From the point of surface grace, if it is A and B rank, a problem and a bird clapper will not be.
[0014] From this experimental result, examination for improving roping in the process which omitted hot-rolling board annealing was performed, the knowledge of the following matter was carried out, and this invention was completed.
(1) The form and distribution state of gamma phase change a lot according to the rolling conditions at the time of rough rolling, and when rough rolling gives 40% or more of accumulation pressing down above 1100 degrees C, carry out the detailed decentralization of the gamma phase. Roping height is reduced, so that gamma phase carries out detailed decentralization.
(2) Even if it elevated-temperature-izes **** temperature after finishing rolling at 750 degrees C and advances recrystallization of a ferrite phase, roping does not improve.
(3) In the improvement of roping, it is gammap. It is gammap although an increase is effective. Although the ear crack at the time of cold-rolling and the increase of a load will arise if too high, it is improvable with making **** into 600 degrees C or less, and B addition.
(4) the above-mentioned B addition — adding — one or more sorts of addition of aluminum and Ti — it can be further improved by roping by compound addition with this and Mg
[0015] And in order to have improved roping, it became clear that it is important at the time of rough rolling to promote decentralization of 15% or more of gamma phase. Especially at the time of heating, if there is little gamma **** and it is made for gamma phase to deposit at the time of rough rolling, roping is improvable.
[0016] gammap shown within the limits of the steel component made into the object of this invention by the lower formula in order to make gamma phase into 15% or more at the time of rough rolling When there was 20% or more, it became clear that the amount required during rough rolling of gamma is also securable.
gammap =420xC+470xN+23xnickel+12xCu+7xMn-11.5xCr-11.5xSi-11xMo — it is important from a viewpoint of decentralization of gamma phase at the time of rough rolling to set up heating temperature as heating conditions for the slab before performing -52xaluminum-49xTi+189 rough rolling, so that gamma phase may deposit or increase during rough rolling If heating temperature is set up so that gamma **** may serve as the maximum at the time of heating, a roping property cannot improve without the ability performing decentralization of gamma phase at the time of rough rolling. This is as remarkable as low-temperature heating, and gamma decentralization at the time of rough rolling is difficult in heating of less than 1100 degrees C. Moreover, when it takes into consideration taking 40% or more of accumulation pressing down above 1100 degrees C, 1150 degrees C or more are desirable as heating temperature. However, since the surface section would cause unusual grain growth by decarbonization and would cause a crack if it heats exceeding 1300 degrees C, the upper limit of heating temperature was made into 1300 degrees C.
[0017] After satisfying a component and heating conditions as mentioned above, decentralization of gamma phase at the time of rough rolling can be attained by making an accumulation rolling reduction 1100 degrees C or more into 40% or more as rough rolling conditions further. Eye a required hatchet made the rolling reduction 1100 degrees C or more 40% or more in order to distribute gamma phase minutely before finishing-after time of rough rolling, or rough rolling - rolling, and it is because gamma deposit to a grain boundary serves as a subject in less than [this]. Moreover, it is gammap even if an accumulation rolling reduction can secure 40%. If it is less than 20% or rolls out at less than 1100 degrees C, it will not distribute but gamma phase will make roping poor. About rolling of 1100 degrees C or more, although it is so desirable that the rolling reduction per one pass is high, even if it divides into a number path and carries out, it is effective. Moreover, by component system by which gamma phase decreases to less than 15% during rough rolling, although it becomes easy to produce recrystallization during hot-rolling, when recrystallization arose, it was also made clear that it was not admitted that roping height decreases remarkably.
[0018] Moreover, gammap It is related and is gammap. It is gammap although roping improves so that it is high. If too high, an ear crack will arise at the time of cold-rolling, and the problem of the increase in a process, such as the load at the time of cold-rolling becoming large, and the number of paths of cold-rolling increasing, or needing intermediate annealing for thin-izing, will arise. It was shown clearly that carrying out elasticity-ization for gamma phase a little enables the load reduction and thin-izing at the time of prevention and cold-rolling of an ear crack about this point. For this reason, in order to reduce the stability of gamma phase, as a result of examining many things, it became clear that elasticity-ization of gamma phase can be attained by adding B in a large quantity from 0.005%, and performing **** below 600 degrees C at the time of ****.
[0019] If **** temperature becomes higher than 600 degrees C, gamma phase will become elasticity too much, or it decomposes into a ferrite phase and carbide and roping nature deteriorates conversely. Consequently, in order to enable elasticity-ization of gamma phase before cold-rolling in this invention, a lot of B is added, and it is gammap by **** 600 degrees C or less. Manufacture of **** in which can improve cold-rolling nature even if higher than before, and a roping-proof property is excellent was attained.
[0020] However, it also sets to this invention and is gammap. If it prescribes that a component exceeds 60%, in the hot-rolling board annealing ellipsis process of this invention, they are an ear crack at the time of cold-rolling, and gamma[since the load increase at the time of cold-rolling and thin-ization of product board thickness become difficult again] p. You may be 60% or less.
[0021] this invention examined further how to distribute gamma phase minutely in a hot-rolling stage. The result which considered as the method of distributing gamma phase in a hot-rolling stage uniformly minutely especially, and

considered the organization change to a cast piece - heating in detail. At the same time a cast piece organization changes from a columnar-crystal subject to one or more sorts of addition of aluminum or Ti, or it by carrying out compound addition of Mg to an equiaxed-grain subject Detailed-ization of particle size was attained, decentralization of gamma phase at the time of rough rolling could be advanced further, and it became clear that roping can be reduced with combination with **** 600 degrees C or less after hot-rolling. In this case, even if respectively independent [at 0.005% or more] as aluminum and an amount of Ti, composite is sufficient again, and it is effective if contained 0.0005% or more as Mg.

[0022] As a result of extending and examining the component range about the above-mentioned relation, being realized by the following component system made the above-mentioned roping reduction method clear. Namely, the component of the ferritic stainless steel which constitutes this invention By weight %, C:0.025 - 0.080%, N:0.0010 - 0.035%, Cr: 11.0-20.0%, S:0.010% or less, P:0.04% or less, Mn: 0.01-1.0%, Si:0.01-1.0%, less than [nickel:0.5%], Cu: Less than [0.5%], less than [Mo:0.2%], O:0.010% or less, B:0.005% ** -0.05% and V:0.001 - 0.5% — further — the need — responding — as a selection element — aluminum: — one or more sorts (0.005 - 0.03% and Ti:0.005-0.05%) or this is made to carry out compound content of the Mg:0.0005-0.02% further

[0023] The reason for limitation of the above-mentioned component is explained in detail below.

C: C is detrimental in respect of corrosion resistance, and although it has a bad influence especially on the corrosion resistance of a weld zone, in order to secure intensity and gamma **** proper, it is required a certain grade. Since processability and ductility would deteriorate if the amounts of gamma run short at less than 0.025% and it adds exceeding 0.080% from a viewpoint of gamma phase, C could be 0.025 - 0.080%.

[0024] N: Although N is so desirable that there are few contents like C to corrosion resistance and processability, since it will become high intensity and processability will deteriorate if it is industrially difficult to make it to less than 0.0010% and adds exceeding 0.035% also in this invention steel, N is taken as 0.0010 - 0.035% of range.

[0025] Cr:Cr is the main element of the ferritic stainless steel of this invention, and in order to secure corrosion resistance, it is necessary to add it 11.0% or more. However, although corrosion resistance improved even if it added exceeding 20.0%, since C for securing the amount of gamma, N, and the amount of Mn increased and processability and toughness deteriorated, the upper limit of Cr was made into 20.0%.

[0026] S: S degrades ductility, toughness, etc., and since it is detrimental also from a corrosion resistance viewpoint, it may be 0.010% or less. Little S is so desirable that there is within limits contained unescapable.

P: P is detrimental also processability, toughness, and in respect of corrosion resistance, and the content may be 0.040% or less so desirably that it is few. Little P is so desirable that there is within limits contained unescapable.

[0027] Although Mn:Mn is added as a deoxidation element, since the effect is saturated with less than 0.01% even if an effect adds exceeding 1.0% rather than is enough, it adds in 0.01 - 1.0% of range.

Although used as a deoxidizer, since Si:Si will promote an embrittlement remarkably and will degrade ductility and toughness if there is no effect sufficient at less than 0.01% and it adds exceeding 1.0%, it is taken as 0.01 - 1.0% of range.

[0028] nickel:nickel is effective as a gamma phase stabilization element — since gamma phase is remarkably stable, intensity will become high too much or processability will deteriorate if it adds so much, it adds at 0.5% or less (it does not contain 0%)

Although Cu:Cu is effective as a gamma phase stabilization element, since intensity will rise remarkably by Cu if it adds so much, it adds at 0.5% or less (it does not contain 0%).

Although Mo:Mo works as a ferrite-phase stabilization element, since intensity will rise and processability will deteriorate if it adds so much, it adds at 0.2% or less (it does not contain 0%).

O: Since O degraded the toughness of a hot-rolling board or caused degradation by the toughness of nozzle plugging at the time of casting, or a crack generating and a hot-rolling board, it could be 0.010% or less in this invention. Little O is so desirable that there is within limits allowed on steel-manufacture technology.

[0029] B: In order that B may attain elasticity-ization of gamma phase, it is an indispensable element, and the effect is ineffective at 0.005% or less, and it is gammap. It is required to add so mostly that it be high. However, if it adds exceeding 0.05%, in order for B compound to deposit so much and to degrade processability and toughness, it adds at 0.05% or less.

V:V fixes C and N at the time of ****, and since [C] it can improve processability, it adds them in 0.001 in all - 0.5% of range in the amount of N.

[0030] In this invention, compound addition of Mg can be carried out at one or more sorts of aluminum and Ti, or this if needed.

Independent addition of the aluminum:aluminum is carried out for fixation of a deoxidizer or N, and also it coexists with Ti or Mg, and it carries out compound addition and can be added at 0.005% or more because of the operation effect of detailed-izing of a cast piece organization. At less than 0.005%, if it does not see and adds exceeding 0.03%, weldability will deteriorate, or since aluminum itself is a powerful ferrite formation element, the above-mentioned effect is made into 0.03% or less for the need of adding gamma stabilization element so much arising etc.

[0031] It adds independently for fixation of a deoxidizer, C, and N, and also it coexists with aluminum or Mg, and by carrying out compound addition, since Ti:Ti acquires the operation effect of detailed-izing of a cast piece organization, it can be added at 0.005% or more. When the above-mentioned effect is not seen but is superfluously added at less than 0.005%, an upper limit is 0.05% because of the need of adding gamma stabilization element so much since it is a ferrite formation [with the improving high thing price] element with powerful bird clapper and Ti itself producing the fixed effect of N etc. It is desirable to consider as 0.03% or less from a viewpoint of roping.

[0032] Mg: Contribute to detailed-ization of a cast piece organization and a hot-rolling organization in this invention, and in order to promote detailed decentralization of gamma phase, add if needed. When adding, compound addition with one or more sorts of aluminum or Ti is required. Moreover, although the detailed-ized effect of a cast piece organization is acquired by 0.0005% or more of addition, even if it adds exceeding 0.02%, since the effect is saturated, it is added in 0.0005 - 0.05% of range.

[0033]

[Example] The ferritic stainless steel of each component shown in Table 1 was ingoted in the vacuum melting of a lab, and 50kg steel ingot with a thickness of 100mm was manufactured. Then, rough rolling was carried out to 20mm with five paths after heating on the conditions shown in Table 2, finish hot-rolling was carried out with six paths from 20mm to 5-3mm, as it was, the hot-rolling board was inserted in the 850-350-degree C furnace, carried out after the 1 hour retention] furnace cooling, and **** was simulated. The **** temperature of front Naka is the retention temperature of this simulation. Then, cold-rolling of the rate of cold rolling was changed and carried out to the after pickling] thickness of 2.0-0.4mm with the sulfuric acid, and subsequent roping height was evaluated. The evaluation method of roping is the same as the above-mentioned method. Although the result was similarly shown in Table 2, according to the manufacture method of this invention, the roping height at the time of cold-rolling was able to acquire the small excellent surface characteristic.

[0034]
[Table 1]

① chemical composition (wt%)

No.	① 成分（wt%）															
	C	Si	Mn	P	S	Cr	Ni	Cu	Mo	O	B	V	N	Al	Ti	Mg
A	0.045	0.38	0.15	0.034	0.0037	16.28	0.07	0.11	0.10	0.0055	0.0085	0.012	0.0084			
B	0.059	0.58	0.80	0.021	0.0045	16.30	0.11	0.04	0.20	0.0048	0.0157	0.045	0.0123	0.006		
C	0.042	0.24	0.30	0.017	0.0017	16.29	0.25	0.10	0.04	0.0031	0.0069	0.105	0.0119		0.010	
D	0.034	0.36	0.37	0.025	0.0052	16.04	0.10	0.09	0.07	0.0040	0.0062	0.079	0.0156		0.015	
E	0.061	0.32	0.24	0.019	0.0061	16.27	0.21	0.01	0.10	0.0030	0.0101	0.065	0.0132	0.021	0.0054	0.0011
F	0.032	0.23	0.81	0.038	0.0037	16.41	0.06	0.42	0.04	0.0032	0.0084	0.054	0.0096	0.027		0.0027
G	0.053	0.30	0.51	0.039	0.0056	16.24	0.07	0.22	0.06	0.0031	0.0069	0.043	0.0251		0.011	0.0008
H	0.056	0.28	0.52	0.021	0.0043	16.11	0.08	0.17	0.10	0.0027	0.0112	0.038	0.0135	0.029	0.007	0.0014
I	0.061	0.18	0.84	0.026	0.0045	16.09	0.21	0.06	0.01	0.0045	0.0164	0.074	0.0154	0.025	0.030	0.0006
J	0.041	0.30	0.21	0.021	0.0030	16.19	0.14	0.07	0.04	0.0029	0.0089	0.091	0.0103	0.018	0.031	
K	0.058	0.29	0.15	0.018	0.0027	16.39	0.10	0.09	0.07	0.0051	0.0242	0.065	0.0172	0.005	0.015	
L	0.020	0.45	0.34	0.026	0.0043	16.18	0.11	0.15	0.09	0.0036	0.0068	0.040	0.0106	0.015		
M	0.056	0.35	0.28	0.024	0.0032	16.27	0.09	0.26	0.05	0.0029	0.0089	0.032	0.0097			
N	0.045	0.44	0.43	0.027	0.0027	16.41	0.15	0.05	0.04	0.0042	0.0076	0.110	0.0184		0.014	
O	0.072	0.25	0.87	0.032	0.0014	16.03	0.45	0.19	0.07	0.0040	0.0228	0.084	0.0311	0.024	0.008	
P	0.051	0.42	0.21	0.036	0.0005	16.68	0.30	0.04	0.03	0.0026	0.0090	0.064	0.0099		0.018	
Q	0.049	0.31	0.53	0.017	0.0065	16.57	0.14	0.13	0.04	0.0033	0.0073	0.047	0.0082	0.030		

[0035]
[Table 2]

No.	γ_p (%)	② 加熱温度 (℃)	③ 熱延			⑧ 冷延			備考
			④ 粗圧延		⑦ 仕上圧延終了温度 (℃)	⑨ 巻取温度 (℃)	⑩ 圧下率 (%)	ローピング評点	
			1100℃以上累積圧下率 ⑤ (%)	⑥ 粗圧上げ温度 (℃)					
A	23.1	1200	60	1070	885	550	80	B	本発明例
B	31.4	1250	80	1107	914	600	70	A	本発明例
C	30.3	1220	70	1084	873	550	73	A	本発明例
D	26.5	1200	50	1051	886	450	60	B	本発明例
E	34.2	1180	40	1043	892	550	70	A	本発明例
F	25.8	1200	60	1080	864	450	80	A	本発明例
G	39.5	1150	70	1091	929	550	90	A	本発明例
H	34.9	1180	40	1042	848	500	70	A	本発明例
I	43.3	1220	60	1086	840	500	80	A	本発明例
J	24.1	1250	40	1035	857	450	73	B	本発明例
K	32.3	1200	60	1044	843	600	60	B	本発明例
L	16.1	1180	50	1036	875	450	73	C	比較例
M	32.5	1200	30	1074	848	450	70	C	比較例
N	28.7	1100	0	954	816	500	80	D	比較例
O	62.9	1150	40	981	865	450	60	A	比較例（耳割れ大）
P	26.1	1200	50	1029	846	700	80	C	比較例
Q	25.8	1250	40	1076	847	750	80	D	比較例

⑪ evaluation of roping

② heating temp. (°C)
③ hot rolling
④ rough rolling
⑤ accumulation rolling reduction at 1100°C or more (%)
⑥ rough rolling temp. (°C)
⑦ hot finishing temp. (°C)
⑧ cold rolling
⑨ coiling temp. (°C)
⑩ reduction ratio (%)

[0036]
[Effect of the Invention] By combining a steel component, the heating conditions at the time of hot-rolling, rough rolling conditions (temperature, accumulation rolling reduction), and **** temperature, also in a hot-rolling board annealing ellipsis process, roping at the time of cold-rolling can be reduced, and, according to the manufacture method of this invention, the ferritic stainless steel which has improved the surface characteristic by the low cost can be offered.

[Translation done.]